Progress Report on Comparisons of East China Sea Bottom Scattering Strengths at Low Frequency

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ECS Bottom Scattering Strength Determinations

- ■ ASIAEX
  - – *Date:* August 2001
  - – *Location:* 29°39'N 126°49'E
  - – *Source Weight/Depth:*1 kg/50 m
  - – *Receiver Depth*: 5-90 m (30 element VLA)
  - – *Geometry*: Monostatic reverberation
- ■ Navy Test #1
  - – *Date*: September 1998
  - – *Location*:28°30'N 126°00'E
  - – *Source Weight/Depth:*2 kg/50 m
  - – *Receiver Depth: 45 m (nominal) (64 element* HLA)
  - – *Geometry*: Bistatic reverberation
- ■ Navy Test #2
  - – *Date*:1998
  - – *Location*:29°05'N 126°43'E
  - – *Source Weight/Depth*: 0.8 kg/18 m
  - – *Receiver Depth*:27 m
  - – *Geometry*: Monostatic reverberation

Bottom Scattering Strength Measurement Sites
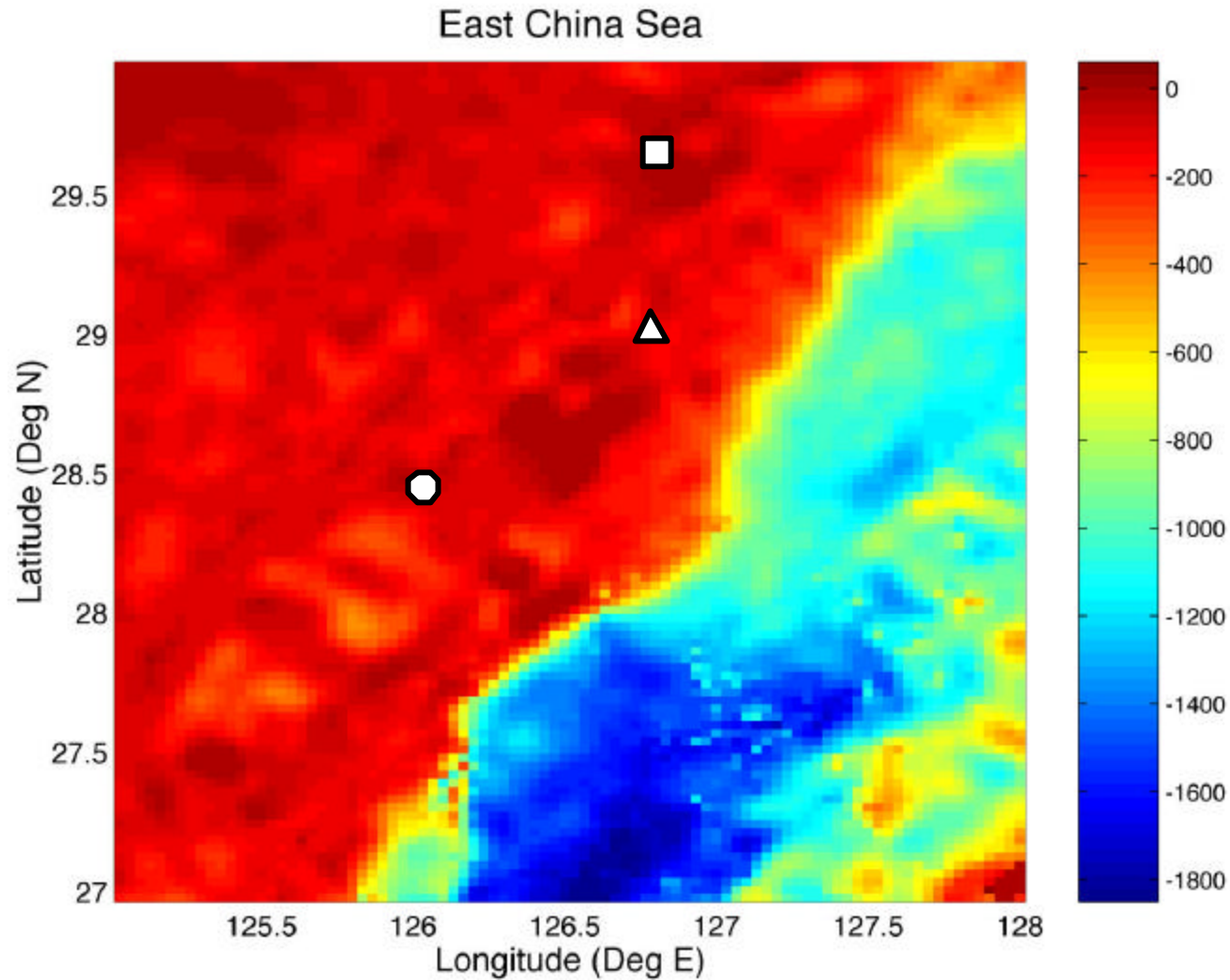
Bottom Scattering Strength Estimation

- Method 1 (ASIAEX, Navy Test #2): Extract scattering strength from reverberation intensity
  - Scale reverberation level for source energy and 2-way transmission
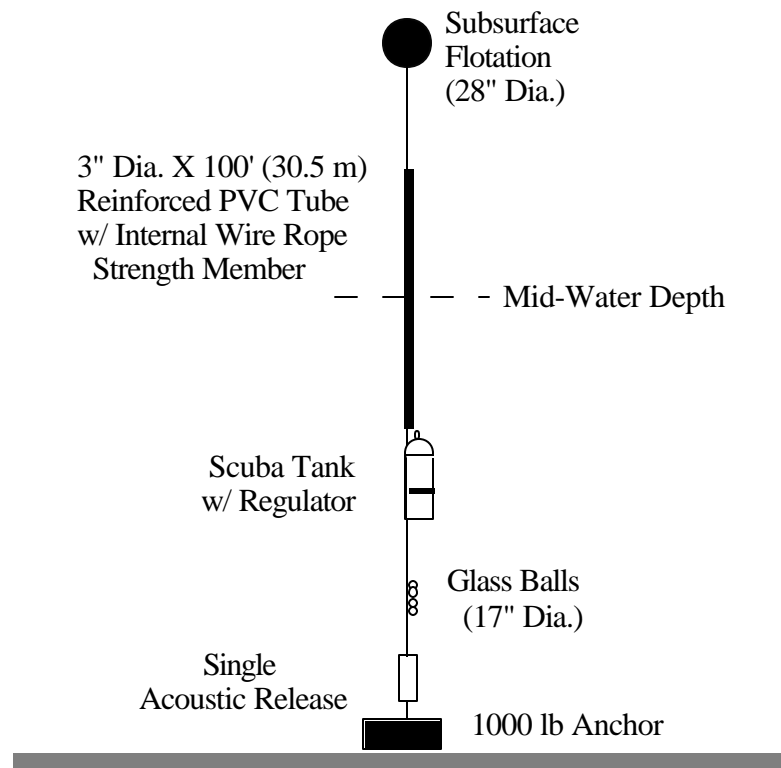 - Adjust for area contributing to instantaneous reverberation level

  Issues/Assumptions:
  - Source level known *vs* frequency & measurement range
  - Transmission known vs frequency & range

- Method 2 (Navy Test #1): Compare bottom target strength & target strength of reference target
  - Compare energy scattered from near-bottom known target with energy scattered from bottom near target
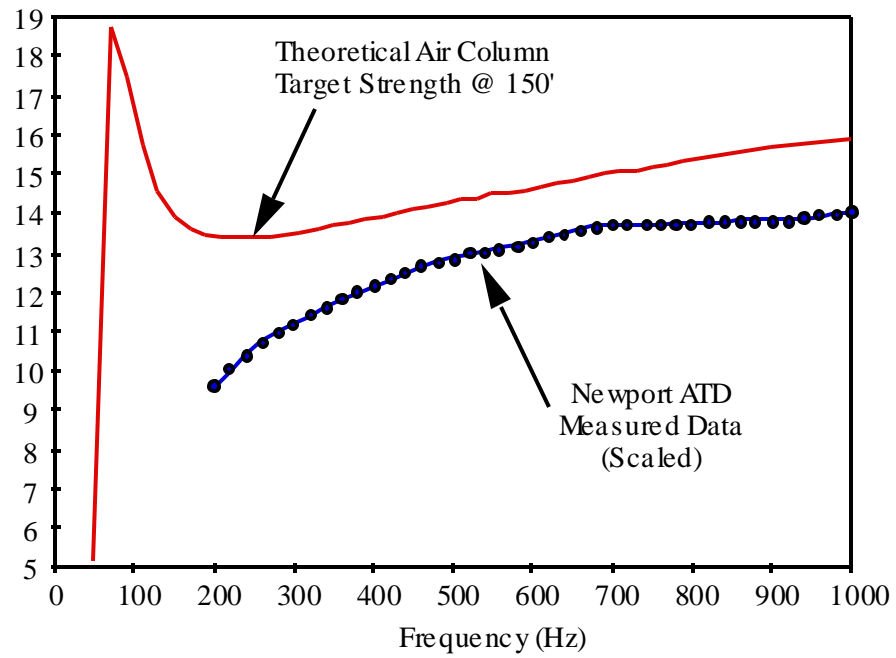 - Adjust bottom target strength for contributing area

  Issues/Assumptions:
  - Same transmission to target & bottom
  - Reference target strength known *vs* frequency

- Both methods typically assume scattering region homogeneity & isotropy

Passive Reflector Schematic

Subsurface
Flotation
(28" Dia.)

3" Dia. X 100' (30.5 m)
Reinforced PVC Tube
w/ Internal Wire Rope
Strength Member

Mid-Water Depth

Scuba Tank
w/ Regulator

Glass Balls
(17" Dia.)

Single
Acoustic Release

1000 lb Anchor

Passive Reflector Target Strength

Summary & Conclusions

- Three separate estimates of East China Sea low frequency integrated bottom scattering strength have been compared
  - Two measurements - ASIAEX & Navy test#2 - were made at closely spaced sites (56 km separation) using same method
    - estimates agree closely
  - One measurement - Navy test#1 - was made at a removed site (140 km separation from ASIAEX) using different method
    - estimates differ from ASIAEX & Navy test#2 results
- Several questions of physics are being probed, the interaction of which affect the interpretation of the scattering strength determinations
  - Source level range dependence expected
    - Consequence of explosive source & nonlinear propagation characteristics
  - Monotonic decrease of scattering strength with range expected
    - Consequence of high angle stripping & scattering strength grazing angle dependence
  - Maximum f^3 dependence of scattering strength expected
    - Consequence of Born approximation scattering applied to sub-bottom scatterers

Plans

- Complete analysis of bottom scattering strength
  - Refine frequency dependency arguments
- Research sub-bottom characterizations for ASIAEX/Navy test#2 sites and for Navy test#1 site
- Undertake construction of scattering strength model